Reason, Rhetoric, and Risk

Hooking Students with Numbers in an Election Year

Matt Salomone

Associate Professor, Mathematics
Director, Math Services
Coordinator, Quantity Across the Curriculum
Bridgewater State University
Bridgewater, MA 02325

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Powerball and the Internet's Armchair Mathematicians

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Why would so many "fall for" this?

What went right in this computation?

Why was Bernie Sanders chosen?

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Why was Bernie Sanders chosen?

Authoritative-sounding, large numbers + motivation to believe conclusion = Perfect trap for the unwary!

Quantitative Reasoning = “Liberal Application” of Mathematical Skill

Quantitative Reasoning	is not the same as	Mathematics	Taylor 2002
Concrete, authentic		Abstract	
Specifying, deductive		Generalizing, inductive	
Relies upon context		Little context	
Socially constructed		Objective	
Political		Apolitical	
Often ad-hoc		Methodical, algorithmic	
Ill-defined problems		Exacting	
Multidisciplinary		Heavily disciplinary	
Emphasizes problem description		Emphasizes problem solution	
Many opportunities to practice		Difficult to locate / practice	
Open-ended, unpredictable		Closed-ended problems	

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Math can be (ineffectively) memorized, but is no guarantee of numeracy.

One Reason for Impaired Numeracy: Cognitive Difficulty with Risk/Probability

A diagnostic puzzle opinionator.blogs.nytimes.com/2010/04/25/chances-are/

A group of 24 practicing physicians were presented with a puzzle.

> The probability that a woman has breast cancer is 0.8 percent.
> Mammograms detect the presence of breast cancer 90% of the time.
> However, 7% of cancer-free women will still test positive on a mammogram.
> **What do you tell a patient who tests positive about the likelihood she has breast cancer?**

	You say...	Doctors said...
(A)	Less than 10%	
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	You say...	Doctors said...
(A)	Less than 10%	**8** (33%)
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(C)	More than 80%	**8** (33%)

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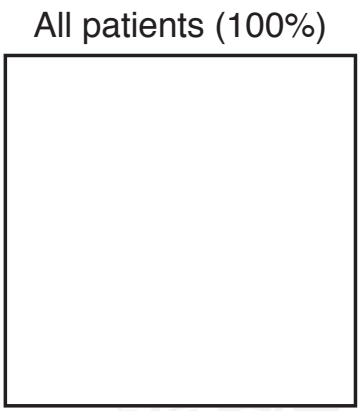

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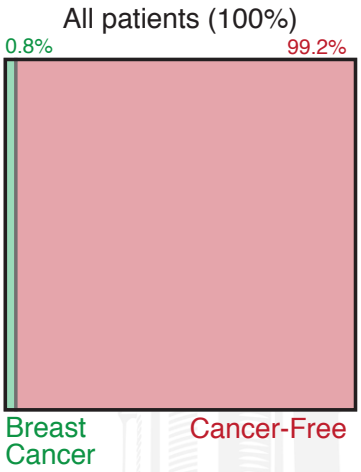

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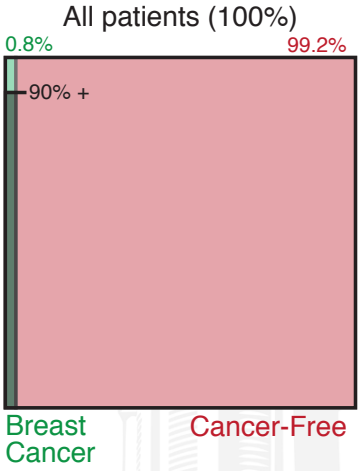

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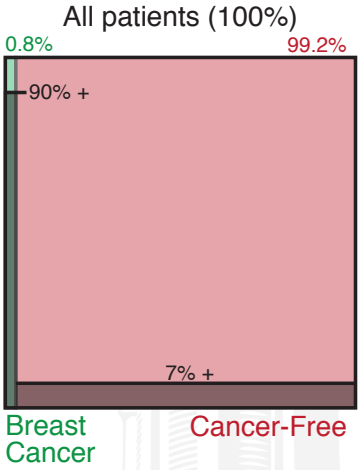

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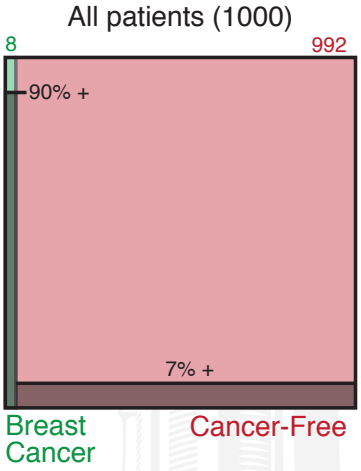

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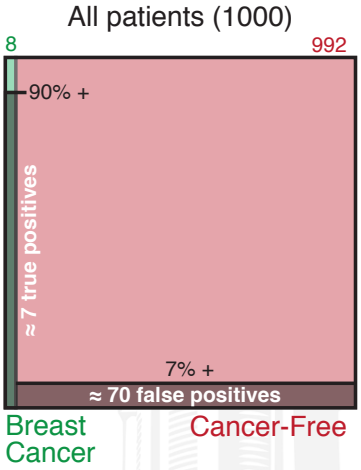

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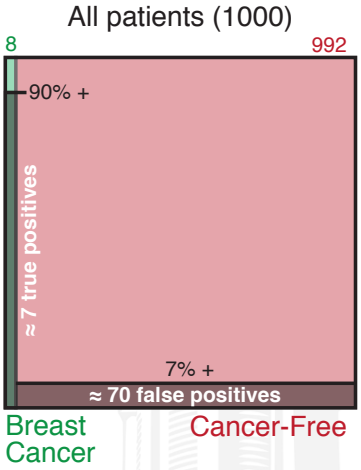

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4. **Emotional valence:** cancer is frightening; fear activates heuristic thinking

Risk is Political — Data Can Keep It Honest

Rank the following causes of death from most risky (5) to least risky (1). thinkbynumbers.org

Cause of death	Votes	Your Rank	Actual Rank
Car accident			
Cancer			
Terrorist attack			
Lightning strike			
Gun homicide			

There are many reasons why we're bad at evaluating risks — but data can temper our innate emotional response.

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Rank the following causes of death from most risky (5) to least risky (1). thinkbynumbers.org

Cause of death	Votes	Your Rank	Actual Rank
Car accident			4
Cancer			5
Terrorist attack			1
Lightning strike			2
Gun homicide			3

There are many reasons why we're bad at evaluating risks — but data can temper our innate emotional response.

Least risky of these causes tends to draw the most political rhetoric! (Why?)

Quantitative Reasoning is Political

Who said it? Match the quote to the candidate

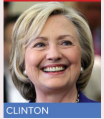
2016 Primary Debates

Free college, a single payer system for health–and it's been estimated we're looking at $18 to $20 trillion, about 40 percent in the federal budget. (Link)

I think the thing about the flat tax, I know it very well. What I don't like is that if you make $200 million a year, you pay ten percent, you're paying very little relatively to somebody that's making $50,000 a year, and has to hire H&R Block to do the – because it's so complicated. (Link)

Republicans win when there is a low voter turnout, and that is what happened last November. Sixty-three percent of the American people didn't vote. Eighty percent of young people didn't vote. (Link)

The math is, 5% of a million is a lot more than 5% of a thousand. So yeah, someone who makes more money, numerically, it's gonna be higher. But the greatest gains, percentage-wise, for people, are gonna be at the lower end of our plan. (Link)



From Numbers to Speech: How'd You Do It?

Takeaways

What did you find most interesting/surprising?

What's one way to use risk and rhetoric to hook students in your course?